Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
2007		**00-00-2007 to 00-00-2007**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Helical Magnetic Fields in the Jet of 3C273	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **United States Naval Observatory,3450 Massachusetts Avenue, NW,Washington,DC,20392-5420**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
Using the VLBA we confirm the presence of a Faraday rotation measure gradient transverse to the jet axis of 3C273. A rotation measure gradient is expected to be the signature of a helical magnetic field wrapping around the relativistic jet.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**2**	

The Central Engine of Active Galactic Nuclei
ASP Conference Series, Vol. 373, 2007
L. C. Ho and J.-M. Wang

Helical Magnetic Fields in the Jet of 3C 273

R. T. Zavala

United States Naval Observatory

G. B. Taylor

Department of Physics and Astronomy, University of New Mexico

G. Giovannini

INAF-Instituo di Radioastronomia and Univ. Bologna

Abstract. Using the VLBA we confirm the presence of a Faraday rotation measure gradient transverse to the jet axis of 3C 273. A rotation measure gradient is expected to be the signature of a helical magnetic field wrapping around the relativistic jet.

1. The Case for Helical Magnetic Fields in 3C 273

The role of magnetic fields in relativistic jets in AGN is a subject of considerable interest. Simulations have produced results that suggest that a helical magnetic field may wind around the jet (Meieret al. 2001; Koide et al. 2002). Before these simulations took place Blandford (1993) suggested that observers look for evidence of a rotation measure (RM) gradient transverse to the jet axis. Such a gradient is expected if a helical or toroidal field is present in the jet and if such a field embedded in a plasma can act as a Faraday rotating screen. Asada et al. (2002) reported the detection of such an RM gradient transverse to the jet axis in 3C 273. These 5 and 8 GHz VLBA observations just began to resolve the jet. We examined higher frequency data and confirmed the presence of the RM gradient over two epochs separated by six months (Zavala & Taylor 2005). We showed that the transverse RM gradient persists over two epochs separated by 6 months. In our poster we reproduced Figures 1 and 3 from Zavala & Taylor (2005). The sense of RM gradient detected in Asada et al. (2002) and Zavala & Taylor (2005) was confirmed by Attridge et al. (2005) at less than 3 pc from the core. This gradient appears to change in magnitude as one proceeds along the jet (Wardle et al. 2006).

This result led us to search for other sources that may exhibit an RM gradient transverse to the jet axis. Other investigators have reported such gradients. However, the amplitude of the gradient is less than that observed in 3C 273 (e.g., Gabuzda et al. 2004). We observed four sources that have broad, polarized jets with the VLBA. Here we present preliminary results for the blazar Mrk 501.

2. Mrk 501

Our VLBA observation of Mrk 501 used frequencies from 8–22 GHz. The RM map is in Fig. 1, and the black line indicates the cut along which we plot the RM in the right panel. No significant gradient in the RM transverse to the jet

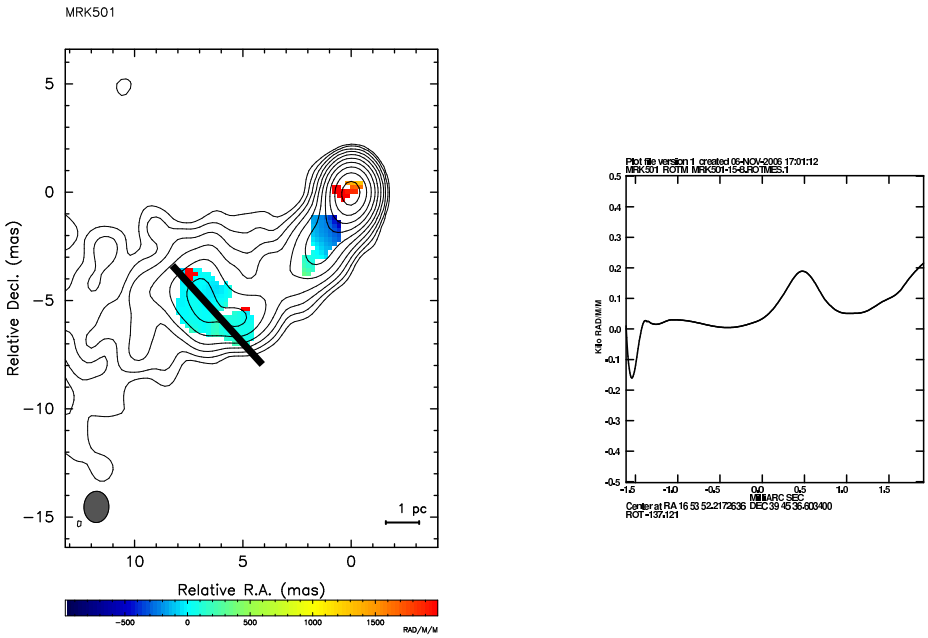

Figure 1. Left panel shows the RM map of Mrk 501 overlaid on total intensity contours. The black line represents the slice across the RM distribution. The slice is shown in the right panel as Kilo rad/m^2 and mas along the slice.

is seen in Mrk 501. As Mrk 501 is a TeV blazar the jet we observe may be significantly different from that in 3C 273. A blazar jet more aligned to our line-of-sight may produce very different Faraday rotation effects from that seen in a more inclined quasar jet. A blazar jet could clear out some of the thermal gas of a Faraday screen. At the scale of Fig. 1 the jet in Mrk 501 changes its orientation angle significantly, which may complicate the picture we see in the RM maps (Giroletti et al. 2004). However, Croke et al. (2005) report an RM gradient suggestive of a helical B field from earlier VLBA epochs.

Acknowledgments. R.T.Z. received an International Travel Grant from the American Astronomical Society.

References

Attridge, J. M., Wardle, J. F. C., & Homan, D. C. 2005, ApJ, 633, L85
Asada, K., et al. 2002, PASJ, 54, L39
Blandford, R. D. 1993, in Astrophysical Jets, ed. D. Burgarella, M. Livio & C. P. O'Dea (Cambridge: Cambridge University Press), 15
Croke, S., Charlot, P., Gabuzda, D., & Sol, H. 2005, Baltic Astronomy, 14, 367
Gabuzda, D. C., Murray, É., & Cronin, P. 2004, MNRAS, 351, L89
Giroletti, M., et al. 2004, ApJ, 600, 127
Koide, S., et al. 2002, Science, 295, 1688
Meier, D. L., Koide, S., & Uchida, Y. 2001, Science, 291, 84
Wardle, J. et al. 2006, in online proceedings of the conference Challenges of Relativisitc Jets, ed. M. Ostrowski & Ł. Stawarz (http://www.oa.uj.edu.pl/2006jets)
Zavala, R. T., & Taylor, G. B. 2005, ApJ, 626, L73